

# NEUTRON DECAY FROM THE SPIN-ISOSPIN EXCITATION IN $^{208}\text{Bi}$ VIA THE $^{208}\text{Pb}(^3\text{He}, t)$ REACTION: IS Pb USEFUL FOR SUPERNOVA NEUTRINO DETECTION?

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Neutrinos and anti-neutrinos are emitted within a few tenth of seconds after the supernova explosion. Neutrino observation is quite important for studying the collapse of star core and neutrino oscillation. The OMNIS (the Observatory for Multiflavor Neutrinos from Supernovae)<sup>1)</sup> in U.S.A. is one of the institutes to have started the observation plans, which uses the  $\text{Pb}(\nu, n)$  reaction to detect supernova neutrinos. It is expected that the energy and time distributions of the supernova neutrinos will provide precious information on the physical mechanisms of neutrino oscillation and supernova explosion. However, detailed knowledge of the response function for the  $\text{Pb} + \nu$  reactions, and of the decays from the residual excited nucleus is indispensable to estimate the total weight necessary for the OMNIS detector that detects  $\sim 1000$  neutrinos in 20 seconds. To obtain information on the energy release after the Charged-Current (CC) reaction in which electron neutrinos are absorbed by Pb, we have measured neutron decay from the spin-isospin resonances in  $^{208}\text{Bi}$ .

The  $^{208}\text{Pb}(^3\text{He}, t + n)$  reaction has been studied in coincidence with neutrons emitted from the excited  $^{208}\text{Bi}$ . The spectrometer, Grand Raiden and 48 liquid scintillators were used in the experiment with a 150 MeV/u  $^3\text{He}$  beam from the ring cyclotron at RCNP.

We could observe clear increases and decreases for observed neutron- and  $\gamma$ -decay at the 1n, 2n, 3n and 4n thresholds. Neutron energy distributions from the excited states in  $^{208}\text{Bi}$  at  $E_x < 32$  MeV have a Maxwell-Boltzmann like structure with a peak energy of 1.2 MeV. The simulation calculation 'CASCADE' well reproduces the global structure for the neutron decay multiplicity. Neutron decay from the isobaric analog state(IAS) was also obtained.

Although neutron decays are mainly statistical, direct decay components were found in the neutron decay from the states around the excitation energy 20 MeV in  $^{208}\text{Bi}$  and from the low lying excited states in the final nucleus  $^{207}\text{Bi}$  by comparing the experimental results with the statistical-model calculation.

[1] R.N. Boyd, G.C. McLaughlin, A.St.J. Murphy and P.F. Smith, J. Phys. G: Nucl. Part. Phys. 29 (2003) 2543.

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